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# Racial Inequities in Receipt of Influenza Vaccination Among Nursing Home Residents in the United States, 2008–2009: A Pattern of Low Overall Coverage in Facilities in Which Most Residents are Black

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## Abstract

**Objectives—**Nationwide among nursing home residents, receipt of the influenza vaccine is 8 to 9 percentage points lower among blacks than among whites. The objective of this study was to determine if the national inequity in vaccination is because of the characteristics of facilities and/or residents.

**Design—**Cross-sectional study with multilevel modeling.

**Setting and Participants—**States in which 1% or more of nursing home residents were black and the difference in influenza vaccination coverage between white and black nursing home residents was 1 percentage point or higher (n = 39 states and the District of Columbia). Data on

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residents (n = 2,359,321) were obtained from the Centers for Medicare & Medicaid Service's Minimum Data Set for October 1, 2008, through March 31, 2009.

**Measurements—**Residents' influenza vaccination status (vaccinated, refused vaccine, or not offered vaccination).

**Results—**States with higher overall influenza vaccination coverage among nursing home residents had smaller racial inequities. In nursing homes with higher proportions of black residents, vaccination coverage was lower for both blacks and whites. The most dramatic inequities existed between whites in nursing homes with 0% blacks (L1) and blacks in nursing homes with 50% or more blacks (L5) in states with overall racial inequities of 10 percentage points or more. In these states, more black nursing home residents lived in nursing homes with 50% or more blacks (L5); in general, the same homes with low overall coverage.

**Conclusion—**Inequities in influenza vaccination coverage among nursing home residents are largely because of low vaccination coverage in nursing homes with a high proportion of black residents. Findings indicate that implementation of culturally appropriate interventions to increase vaccination in facilities with larger proportions of black residents may reduce the racial gap in influenza vaccination as well as increase overall state-level vaccination.

## Keywords

Immunization; long term care; racial inequities

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Nationally, influenza vaccination coverage among nursing home residents has risen only slightly according to the latest data from the Centers for Medicare & Medicaid Services (CMS), from 66.4% in 2004 to 69.5% in 2009,[1–3] remaining well below the Healthy People 2010 and 2020 goals of 90%.[4] Receipt of influenza vaccine was 8 to 9 percentage points lower among blacks than among whites in nursing homes from 2005 through 2009.[1,3,5,6] From state to state, racial differences are highly variable among nursing home residents, from 2 percentage points higher for blacks than whites in Alaska but lower for blacks than whites in most states and up to 21 percentage points lower in Michigan.[6]

In a previous study, we examined the racial inequity in influenza vaccination among nursing home residents in Michigan.[7] An inequity is defined as the unequal distribution of health determinants, outcomes, and resources within and between segments of the population, regardless of social standing.[8] Thus, we defined racial inequity as the difference between white and black nursing home residents in receipt of the influenza vaccine. To examine racial inequity, we used multilevel modeling, a method that allows for estimating the vaccination status for whites and blacks for each nursing home[9] while adjusting for facility-level characteristics, such as type of ownership (eg, proprietary, nonprofit, or government) and the proportions of whites and blacks in the home; resident-level characteristics, such as age and gender; and the variability in vaccination coverage among nursing homes. We found that the inequity in influenza vaccination coverage was largely because of between-facility differences. Further, the differences were observed between facilities based on racial composition of the facility. In facilities where all residents were white, an adjusted 81.7% of white residents were vaccinated; however, in facilities where 50% or more of the residents were black, an adjusted 46.3% of all residents were vaccinated. In contrast, within-facility

differences were small: in the facilities where 50% or more of the residents were black, median coverage was only 5.3 percentage points higher among whites than blacks (an adjusted 50.7%). Although contributing less to the overall gap than the between-facility differences, this small within-facility difference shows that individual-level characteristics also were related to the inequities. The within-facility difference was partly because of blacks refusing the influenza vaccine more often than whites.

It is unknown whether racial inequities in influenza vaccination among nursing home residents in other states follow the pattern identified in Michigan. Therefore, we used multilevel analysis for each state to estimate vaccination status for residents for the 2008 to 2009 influenza season, adjusted for facility- and individual-level characteristics. Our results are stratified by state into groupings that reflect the degree of inequity in influenza vaccination among nursing home residents in the states, and, as in the previous study, stratified by nursing homes into groupings that reflect the proportion of white and black residents in each nursing home.

## Methods

We define racial inequities as the difference between vaccination coverage among white residents and black residents. Because the objective of our study was to determine if racial inequities in influenza vaccination among nursing home residents in other states follow the same pattern identified in Michigan, we limited our analysis to the states in which 1% or more of nursing home residents were black (n = 40; 39 states and the District of Columbia) and the difference in influenza vaccination coverage between white and black nursing home residents was 1 or more percentage point for the 2008 to 2009 influenza season (Figure 1A). We computed a multilevel analysis for each state. The outcome of each model was the resident-level adjusted vaccination status for each nursing home. For each state, medians of vaccination status for whites and blacks are reported for each stratum of nursing homes by the proportion of black residents.

### Study Population

Our study population included 2,359,321 nursing home residents from 14,998 facilities certified by the CMS in the 39 states and the District of Columbia (Figure 1A and B). Data were obtained from resident assessment instruments completed from October 1, 2008, through March 31, 2009. By law, these assessments are completed using medical records for all residents in Medicare/Medicaid-certified facilities by nurses at admission, quarterly thereafter, and when any significant change in condition occurs.[10]

### Multilevel Model

The dependent variable in each model was each resident's influenza vaccination status (vaccinated inside or outside the nursing home, refused vaccine, and not offered vaccination). The immunization supplement to the required assessment asks, "Did the resident receive the influenza vaccine in this facility for this year's influenza season (October 1 through March 31)?" The next question asks, "If influenza vaccine was not received, state reason: (1) not in facility during this year's flu season; (2) received outside of

this facility; (3) not eligible; (4) offered and declined; (5) not offered; and (6) inability to obtain vaccine." For most residents, data were available from more than one assessment for the 2008 to 2009 influenza season. If more than one vaccination status was indicated, we assigned a single status: vaccinated, if vaccination was ever documented; followed by contraindicated; refused; or not offered. For example, if a resident's records indicated both that the vaccine had been refused and that vaccine had not been offered, the resident was considered to have refused vaccine.[2]

The multilevel models were adjusted for 3 resident-level factors: gender, age, and race. The assessment instrument has one variable for race/ethnicity with responses of (1) American Indian/Alaskan Native, (2) Asian/Pacific Islander, (3) black, not of Hispanic origin, (4) Hispanic, and (5) white, not of Hispanic origin. The multilevel models were also adjusted for 2 facility-level factors: the total number of residents in the facility and the proportion of black residents in the facility during the influenza season. Because of small sample sizes for races/ethnicity other than white and black, vaccination coverage estimates for other races/ethnicity are not presented.

## Statistical Analysis

To assess for a pattern in inequity in vaccination among nursing home residents in the 39 states and the District of Columbia, we first calculated and plotted state-level, unadjusted inequity in vaccination coverage among nursing home residents versus the proportion of nursing home residents vaccinated, the proportion of nursing home residents vaccinated versus the proportion of black nursing home residents, and the inequity in vaccination coverage among nursing home residents versus the proportion of black nursing home residents. We conducted simple linear regression to assess statistical significance.

To further assess whether a pattern exists in the 39 states and the District of Columbia, we conducted a multilevel analysis for each state. From the models' odds for likelihood of vaccination status in each nursing home, we calculated the percent vaccinated, percent offered vaccine, and the percent that refused vaccine for whites and blacks for each nursing home, adjusting for covariates. For each state, median adjusted vaccination coverage is given for nursing homes in 5 levels: with 0% (L1), 0.1% to 4.9% (L2), 5.0% to 19.9% (L3), 20.0% to 49.9% (L4), and 50% or more (L5) black residents. To examine variability in vaccination *between* nursing homes, we tested the significance of a random intercept (ie, null hypothesis of variance equal to zero) in the multilevel model that included all facilities in the state. States were grouped by the degree of inequity in each state (ie, 1.0–4.9 percentage points, 5.0–9.9 percentage points, and ≥10 percentage points). To compare vaccination coverage *within* racially mixed nursing homes (i.e., ≥1 black resident in the facility) in each state, we examined those homes separately (n = 11,157 nursing homes).

For each state, we also examined the distribution of black residents across the strata of racially mixed nursing homes. Last, we examined adjusted probabilities of not being offered vaccine and vaccine refusal for whites and blacks.

We used HLM v.6.08 software (Scientific Software International, Inc., Lincolnwood, IL) to conduct the multilevel analyses.

This study was reviewed by the Human Subjects Coordinator at the Centers for Disease Control and Prevention and as an analysis of secondary data without identifiers, was determined not to require Institutional Review Board review.

## Results

Influenza vaccination coverage among nursing home residents in the 39 states and the District of Columbia varied widely (median = 72.7%, range: 49.4%–80.9%); adjusted vaccination coverage by quartiles was 49.4%–68.3%, 68.4%–72.8%, 72.9%–76.8%, and 76.9%–80.9% (Figure 1B). The median state vaccination coverage among white nursing home residents was 74.1% and for black residents was 66.0%, a difference of 8.1 percentage points. Overall, inequity in vaccination among nursing home residents decreased as vaccination coverage among nursing home residents increased ($\beta = -40.6$, $P = .07$) (Figure 2); however there was no relationship between the state-level proportion of nursing home residents vaccinated and the proportion of black nursing home residents ($\beta = -3.2$, $P = .68$) (Figure 3), nor between inequities in vaccination coverage among nursing home residents and the proportion of black nursing home residents ($\beta = -0.01$, $P = .81$) (Figure 4).

Unadjusted inequities of 10 or more percentage points existed in 10 states, of 5.0 to 9.9 percentage points in 17 states, and 1.0 to 4.9 percentage points in 12 states and the District of Columbia. In Alaska, influenza coverage among black nursing home residents was 2 percentage points higher than among white nursing home residents.

In the stratum of states with influenza vaccination inequities of 10 or more percentage points, the median adjusted vaccination coverage was highest in L1 facilities (range: 67.7%–88.0%) and lowest among white and black residents in L5 facilities (range for whites: 40.4%–71.3%; for blacks: 37.1%–64.2%) (Table 1). In states with vaccination inequities of 5.0 to 9.9 percentage points, findings were similar but the differences were less marked. In states with inequities of 1.0 to 4.9 percentage points, differences in vaccination coverage were small.

When comparing median adjusted differences of proportions for whites and blacks *within* each racially mixed nursing home in each state (n =11,157 nursing homes), we found the white-black differences within nursing homes were small (median difference range: 2.1–2.5).

Compared with states where inequities were fewer than 10 percentage points, in states with 10 or more percentage point inequities, blacks disproportionately lived in L5 nursing homes (43.6%), compared with the other states (states with 5.0–9.9 percentage point inequities: 25.5%; states with 0.1–4.9 percentage point inequities: 27.8%).

The median probability of not being offered vaccine was highest for all residents of nursing homes in the states with inequities of 10 or more percentage points (range: 11.1% among whites in homes with no blacks – 24.1% among blacks in homes with 50% or more blacks), followed by states with 5.0 to 9.9 percentage point inequities (range: 9.5% among whites in L1 homes – 18.1% among blacks in L5 homes) and states with 0.1 to 4.9 percentage point inequities (range 9.0% among whites in L1 homes – 13.0% among blacks in L5 homes).

State median probabilities of refusing vaccine were highest for blacks and whites among all strata of nursing homes in the states with inequities of 10 or more percentage points (range: 8.4% among whites in L1 homes – 15.9% among blacks in L5 homes), followed by states with 5.0 to 9.9 percentage point inequities (range: 6.0% among whites in L1 homes – 11.7% among blacks in L5 homes) and states with 0.1 to 4.9 percentage point inequities (range 7.0% among whites in L1 homes – 10.1% among blacks in L5 homes).

## Discussion

In general, the smallest inequities in coverage between white and black nursing home residents were observed in states with the highest overall influenza vaccination coverage among nursing home residents. Similar to what we found in Michigan, in states with influenza vaccination inequities of 10 or more percentage points, coverage varied more between homes categorized according to racial composition of residents than it did within homes. Both for states with more than 10 percentage points and 5.0 to 9.9 percentage point inequity, coverage for both white and black residents decreased as the proportion of black residents increased. Along with this, in the states with the greatest inequities, black residents disproportionately lived in nursing homes with 50% or more blacks (L5 homes). Thus, blacks disproportionately residing in homes where coverage is low was the main contributor to inequities at the state level. In addition, in most nursing homes in most states, coverage among blacks was almost always lower than among whites, although these differences were smaller than the differences between the groups of homes categorized by racial composition.

From our results, derived from modeling each state independently, it is reasonable to conclude that the patterns of racial differences we found are because of factors that vary from nursing home to nursing home rather than because of factors that vary by state or region. In our models, use of random effects accounted for the variability in vaccination coverage between nursing homes in each state. That is, differences in vaccination coverage, refusals, or not being offered the vaccine because of unmeasured factors at the facility level, were held constant across states. Because vaccination coverage is higher in some states in L5 homes (≥ 50% black residents), those states may have a higher prevalence of the nursing home–level factors associated with better coverage.

Many of the states in which black nursing home residents disproportionately lived in L5 homes (≥ 50% blacks) were also among the lowest quartile of states in terms of overall vaccination coverage in nursing home residents. Other studies have found that the proportion of black residents in nursing homes correlates with the proportion of Medicaid residents, and correspondingly, with lower reimbursement for most services.[11] However, influenza vaccination coverage among nursing home residents increases as the proportion of residents on Medicaid increases.[12] Therefore, our results suggest that the proportion of black residents is a strong contributor to inequities in vaccination, even without controlling for Medicaid at the individual level, which very well may have decreased the gap.

Although annual influenza vaccination (1) is recommended for all nursing home residents by the Advisory Committee on Immunization Practices (ACIP),[13] (2) is funded by Medicare, and (3) is required by CMS to be offered to all nursing home residents for facility

certification,[14] inequities in offering vaccine among nursing homes remain. In fact, another study recently published that excluded many groups of nursing home residents indicated for the influenza vaccine by the ACIP, still found that blacks tend to reside in homes that have lower vaccination rates in general than whites, and that blacks are less likely to be vaccinated in the same facility as whites.[15] These results suggest that a targeted effort to understand and overcome barriers to vaccination in facilities with low coverage where 50% or more of residents are black could substantially reduce disparities. Because our results suggest the differences lie at the facility level, unmeasured factors, such as the degree of implementation of facility vaccination programs, the beliefs of staff, and/or the race/ethnicity of staff, may play important roles in receipt of vaccine among nursing home residents. Further studies are needed to explore how vaccine-offering levels change in light of the CMS requirement of offering the vaccine to be certified.

A limitation of this study is that we did not have level of vaccination coverage among health care workers in the nursing homes, which may well have been associated with the resident-level vaccination coverage. In addition, vaccination status on the Minimum Data Set has not been validated. Although the data used are reported from chart reviews by facility staff, no systematic quality checks for vaccination information are conducted; thus, vaccination could be underreported or status could be misclassified. Also, these data cannot be used for an analysis of disparities that may exist for persons of Hispanic ethnicity: “Hispanic” is a mutually exclusive choice from white and black and therefore potential disparities for persons of Hispanic ethnicity cannot be thoroughly examined, because some persons of Hispanic ethnicity may select their race instead of their ethnicity. Further, we did not have information on the race or ethnicity of the nursing home staff.

We did not adjust for individual-level socioeconomic status (SES) in our analysis. Our primary objective was to determine whether state-level disparities in vaccination were largely attributable to black nursing home residents being concentrated in nursing homes where coverage was low (regardless of resident race). Therefore, we sought to describe the pattern of these disparities, not to explain the potential contribution of SES to them. We do not anticipate that adjusting for SES would affect results related to within nursing home vaccination differences by race because SES within nursing homes is fairly homogeneous regardless of race.[16,17] In a previous analysis conducted in Michigan,[7] results were unchanged when SES was adjusted for compared with when it was not, that is, we found similar low vaccination coverage in nursing homes with a high proportion of black residents and small within–nursing home black-white differences persisted (results from the unadjusted are unpublished).

Our data demonstrate the heterogeneity in vaccination coverage among states overall, and between strata defined on the basis of resident racial composition. A strength of our study is that our analytic approach of stratifying by state (ie, holding state constant) adjusts for regional differences in access to health care. This is important because race and region are highly significant confounders of the relationship between use of facility-wide standing orders for influenza vaccination with receipt of the influenza vaccine.[12]

Influenza vaccination inequity is negligible among residents of nursing homes with standing order protocols for vaccination.[18] Because use of standing orders among nursing homes is low (40%),[17] intervention studies are needed to determine the extent of barriers to establishing standing orders as well as the impact of implementation of policies, such as standing orders, on narrowing disparities and to identify other effective interventions at both the facility and individual levels. The finding that states with higher overall coverage among nursing home residents have lower inequities may provide a source of insight into narrowing inequities in other states. More research is needed to identify facility-level characteristics, including vaccination policies, which result in higher coverage for all residents.

## Conclusion

The smallest inequities in coverage between white and black nursing home residents were observed in states with the highest overall influenza vaccination coverage among nursing home residents. Inequities in influenza vaccination coverage among nursing home residents are largely a result of low vaccination coverage in nursing homes with a high proportion of black residents. Findings indicate that implementation of culturally appropriate interventions to increase vaccination in facilities with larger proportions of black residents may reduce the racial gap in influenza vaccination as well as increase overall state-level vaccination.

## References

1. Bardenheier B, Wortley PM, Shefer A. Influenza vaccine among African-American and white nursing home residents: Is there a gap? J Am Geriatr Soc. 2009; 57:2164–2165. [PubMed: 20121969]
2. Bardenheier B, Wortley PM, Ahmed F, et al. Influenza immunization coverage among residents of long-term care facilities certified by CMS, 2005–2006: The newest MDS quality indicator. J Am Med Dir Assoc. 2010; 11:59–69. [PubMed: 20129216]
3. Bardenheier, B.; Shefer, A.; Wortley, P., et al. Trend in Influenza Immunization Coverage among Residents of Nursing Homes Certified by CMS, 2005–2010. Washington, DC: National Immunization Conference; 2011.
4. US Department of Health and Human Services. With Understanding and Improving Health and Objectives for Improving Health. 2. Vol. 2. US Government Printing Office; Washington, DC: Nov. 2000 Healthy People 2010.
5. Bardenheier B, Shefer A, Mckibben L, et al. Characteristics of long-term-care facility residents associated with receipt of influenza and pneumococcal vaccinations. Infect Control Hosp Epidemiol. 2004; 25:946–954. [PubMed: 15566029]
6. Bardenheier, B.; Wortley, PM.; Ahmed, F.; Sullivan, K. Influenza vaccination coverage and racial disparities in vaccination among US long-term care residents, 2005–2006. Dallas, TX: National Immunization Conference; 2009.
7. Bardenheier B, Wortley PM, Ahmed F, Gravenstein S, et al. Racial inequities in receipt of influenza vaccination among long-term care residents within and between facilities in Michigan. Med Care. 2011; 49:371–377. [PubMed: 21368681]
8. Klein, R.; Keppel, K. Disparities, inequities, and inequalities. Chicago, IL: Academy Health Annual Research Meeting; 2009.
9. Diez-Roux AV. Multilevel analysis in public health research. Annu Rev Public Health. 2000; 21:171–192. [PubMed: 10884951]
10. Institute of Medicine. Improving the Quality of Long-Term Care. Washington D.C: National Academy Press; 2001.

11. Gruneir A, Miller SC, Feng Z, et al. Relationship between state Medicaid policies, nursing home racial composition, and the risk of hospitalization for black and white residents. Health Serv Res. 2008; 43:869–881. [PubMed: 18454772]
12. Bardenheier B, Shefer A, Lu P, et al. Are standing order programs associated with influenza vaccination? – NNHS, 2004. J Am Med Dir Assoc. 2010; 11:654–661. [PubMed: 21030000]
13. Centers for Disease Control and Prevention. Prevention and Control of Influenza with Vaccines. Recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR Morb Mortal Wkly Rep. 2010; 59:1–62. [PubMed: 20075837]
14. Centers for Medicare & Medicaid Services. [Accessed February 18, 2009] Medicare and Medicaid Programs; Condition of Participation: Immunization Standard for Long Term Care Facilities; Final Rule. Federal Register Part III. Available at: http://edocket.access.gpo.gov/2005/pdf/05-19987.pdf
15. Cai S, Feng Z, Fennell M, Mor V. Despite small improvement, black nursing home residents remain less likely than whites to receive flu vaccine. Health Aff (Millwood). 2011; 30:1939–1946. [PubMed: 21976338]
16. Mor V, Zinn J, Angelelli J, et al. Driven to tiers: Socioeconomic and racial disparities in the quality of nursing home care. Milbank Q. 2004; 82:227–256. [PubMed: 15225329]
17. Angelelli J, Grabowski DC, Mor V. Effect of educational level and minority status on nursing home choice after hospital discharge. Am J Public Health. 2006; 96:1249–1253. [PubMed: 16735621]
18. Bardenheier B, Shefer A, Ahmed A, et al. Do racial inequities in receipt of influenza vaccination among nursing home residents narrow if facility vaccination policies exist? Results of the National Nursing Home Survey, 2004. J Am Geriatr Soc. 2011; 59:687–693. [PubMed: 21438863]

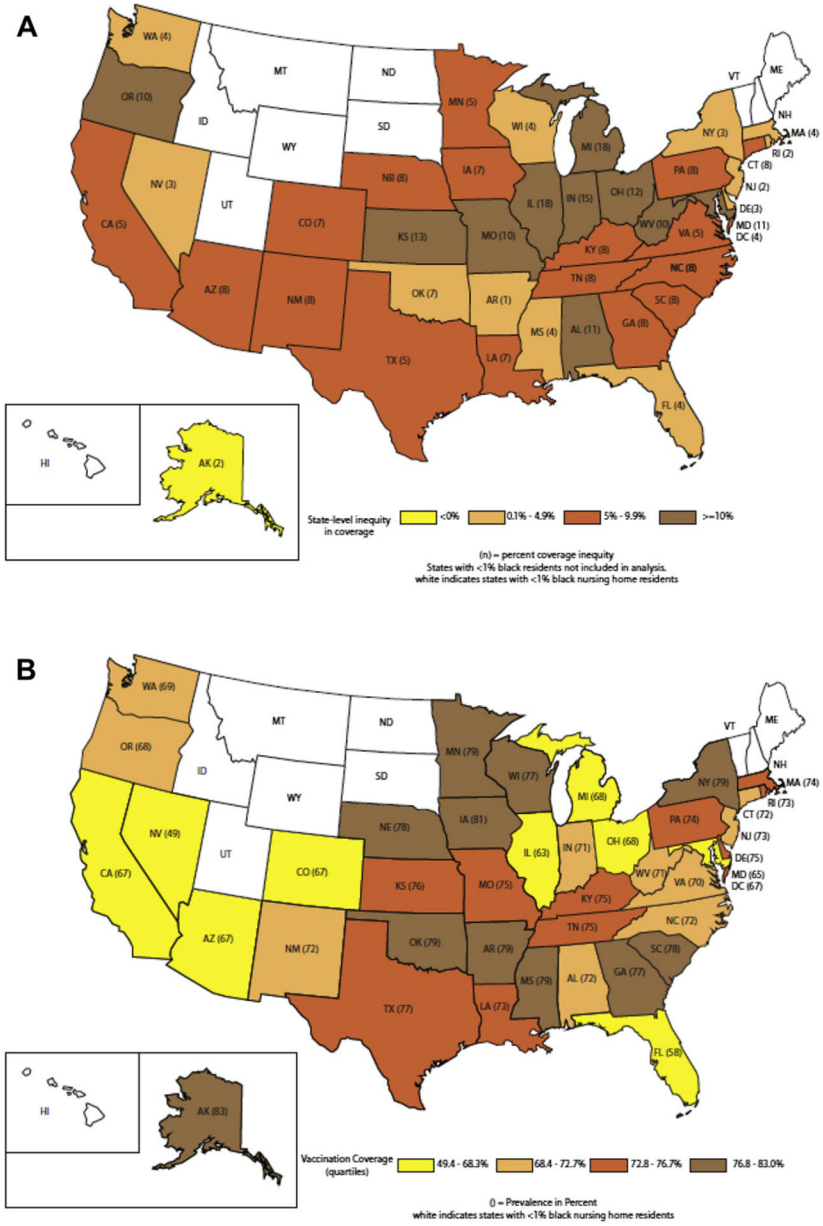


**Fig. 1.**

(A) Inequities in influenza vaccination among white and black nursing home residents by state, United States, 2008–2009. (B) State influenza vaccination coverage among nursing home residents, 2008–2009.

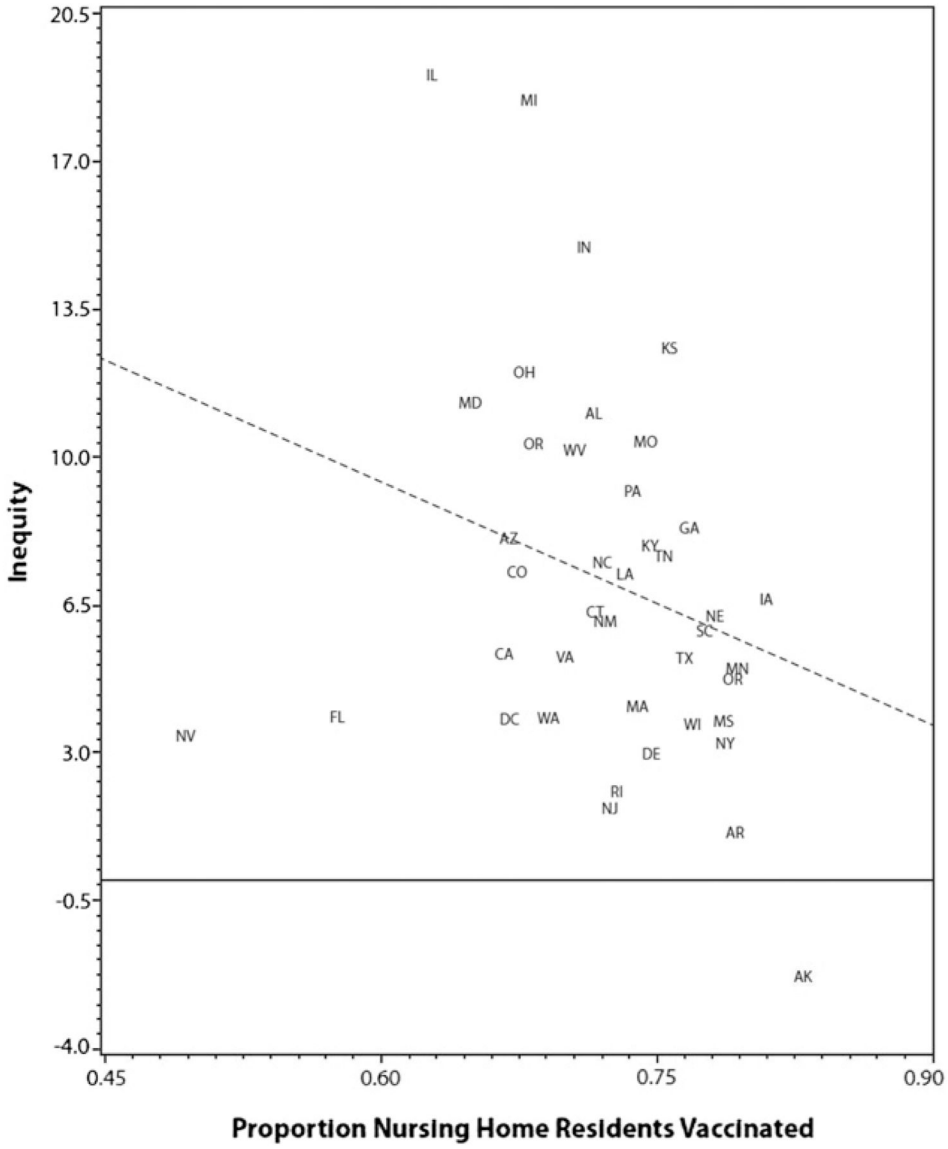


**Fig. 2.**

Inequity in influenza vaccination among nursing home residents by proportion nursing home residents vaccinated in the state, 2008–2009 season.

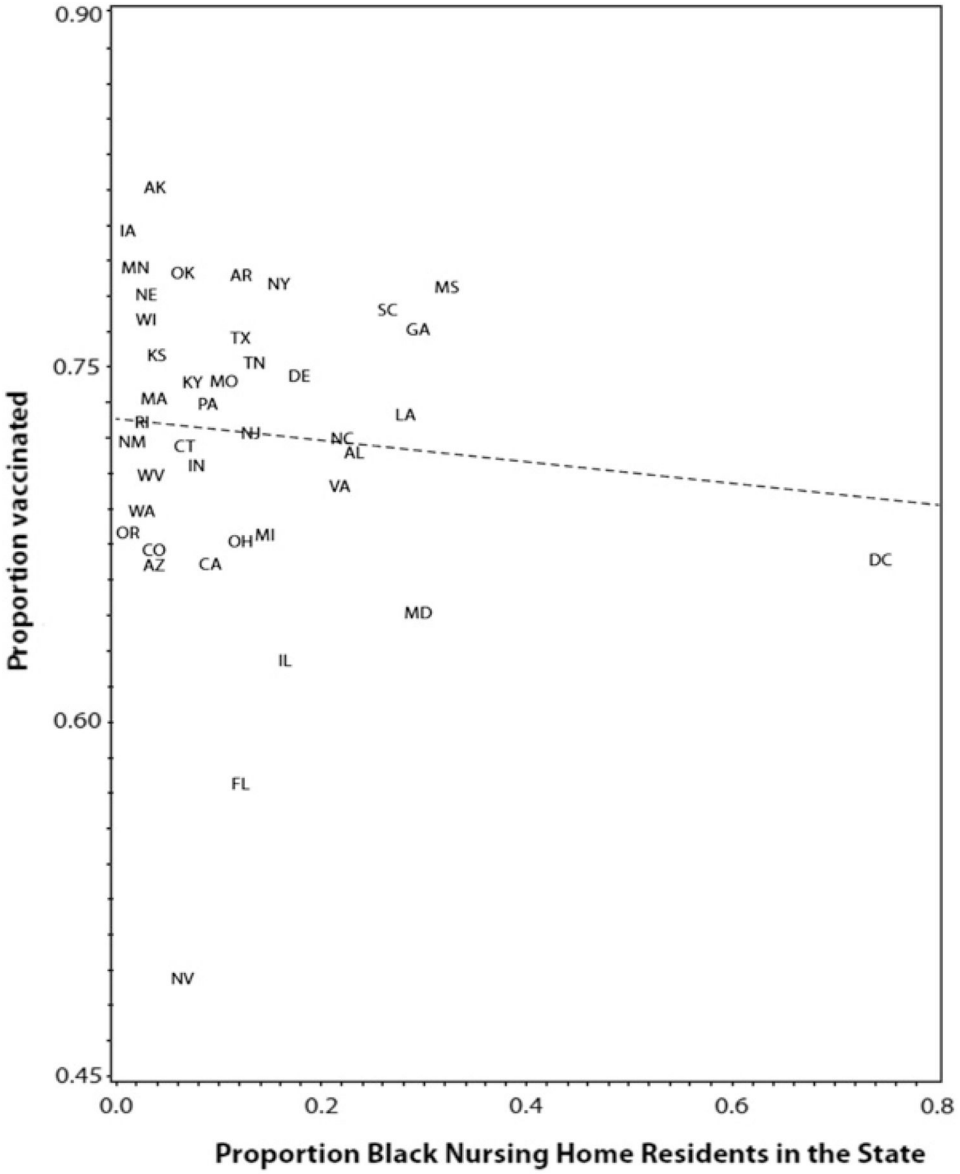


**Fig. 3.**

Proportion of nursing home residents vaccinated in the state by proportion of black nursing home residents in the state, 2008–2009 season.

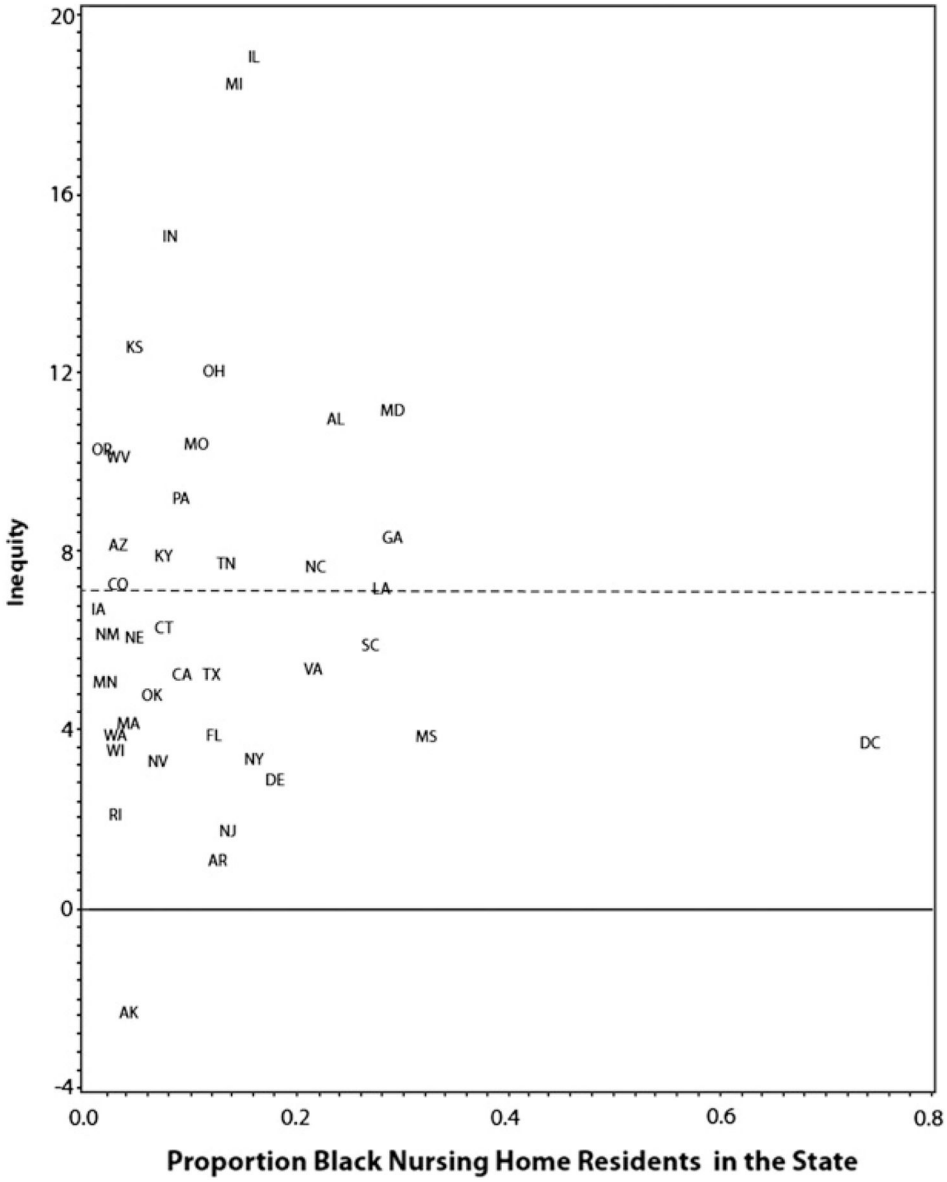


**Fig. 4.**

Inequity in influenza vaccination among nursing home residents by proportion of black nursing home residents in the state, 2008–2009 season.

## Table 1

Adjusted Probability Vaccination Status, Stratified by % Black Residents in Facility, by State—Minimum Data Set, United States 2008–2009

| Reporting area | W-B gap | % residents in state are black | Facilities Grouped by % Black Residents in the Homes | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0% Blacks (L1) | 0.1%–4.9% Blacks (L2) | | 5.0%–19.9% Blacks (L3) | | 20.0%–49.9% Blacks (L4) | | ≥50% Blacks (L5) | |
| | | | Vaccinated | Vaccinated | | Vaccinated | | Vaccinated | | Vaccinated | |
| | | | White | White | Black | White | Black | White | Black | White | Black |
| States with ≥10% white-black difference in vaccination | | | | | | | | | | | |
| Illinois | 19.2 | 16.2 | **76.1** | 70.1 | 67.4 | 65.9 | 63.0 | 53.4 | 50.2 | **40.4** | **37.1** |
| Michigan | 18.6 | 14.4 | **79.2** | 74.3 | 70.2 | 70.6 | 67.2 | 62.5 | 58.9 | **49.1** | **46.2** |
| Indiana | 15.1 | 7.6 | **79.3** | 74.5 | 71.5 | 69.7 | 66.9 | 53.8 | 50.8 | **58.6** | **56.0** |
| Kansas | 12.7 | 4.7 | **82.1** | 77.1 | 72.9 | 67.4 | 61.9 | 59.7 | 54.2 | **65.2** | **59.6** |
| Ohio | 12.1 | 12.4 | **76.2** | 74.4 | 71.7 | 67.3 | 64.4 | 60.9 | 57.5 | **56.9** | **53.6** |
| Maryland | 11.4 | 29.5 | **84.3** | 79.4 | 78.9 | 74.5 | 73.9 | 65.0 | 64.2 | **59.9** | **58.5** |
| Alabama | 11.1 | 23.6 | **88.0** | 82.2 | 77.2 | 77.3 | 76.1 | 72.7 | 66.0 | **71.3** | **64.2** |
| Missouri | 10.5 | 10.4 | **80.7** | 77.7 | 78.9 | 76.9 | 73.9 | 74.2 | 64.2 | **66.0** | **58.5** |
| Oregon | 10.4 | 1.6 | **67.7** | 67.5 | 61.6 | 63.3 | 57.1 | 60.3 | 54.1 | n/a | n/a |
| West Virginia | 10.3 | 3.3 | **77.2** | 71.7 | 63.3 | 70.3 | 61.7 | n/a | n/a | n/a | n/a |
| **Median** | | 11.4 | **79.3** | 74.5 | 71.6 | 70.0 | 65.7 | 60.9 | 57.5 | **59.3** | **57.3** |
| States with 5.0%–9.9% white-black difference in vaccination | | | | | | | | | | | |
| Pennsylvania | 9.3 | 9.1 | **79.5** | 75.7 | 75.8 | 70.7 | 72.0 | 68.3 | 68.1 | **59.1** | **68.2** |
| Georgia | 8.4 | 29.1 | **85.6** | 84.4 | 81.2 | 82.5 | 78.5 | 82.2 | 77.6 | **76.2** | **72.0** |
| Arizona | 8.2 | 3.5 | **74.7** | 69.3 | 69.1 | 62.7 | 61.9 | 25.7 | 25.6 | n/a | n/a |
| Kentucky | 8.0 | 7.3 | **81.4** | 77.6 | 74.8 | 76.2 | 73.7 | 69.2 | 67.2 | **65.1** | **62.1** |
| Tennessee | 7.8 | 13.4 | **79.5** | 78.0 | 74.2 | 75.6 | 71.6 | 73.1 | 69.4 | **73.7** | **69.7** |
| North Carolina | 7.6 | 22.3 | **79.4** | 80.7 | 77.9 | 75.4 | 72.8 | 70.4 | 67.8 | **69.5** | **67.2** |
| Colorado | 7.4 | 3.7 | **78.8** | 64.5 | 65.4 | 55.7 | 56.3 | 48.3 | 49.0 | **46.6** | **47.5** |
| Louisiana | 7.3 | 28.3 | **84.2** | 77.7 | 74.9 | 79.4 | 76.1 | 72.1 | 68.5 | **71.4** | **67.5** |
| Iowa | 6.8 | 1.2 | **82.1** | 80.9 | 77.4 | 77.4 | 73.7 | n/a | n/a | n/a | n/a |
| Connecticut | 6.4 | 7.2 | **76.5** | 71.8 | 70.3 | 67.9 | 66.7 | 58.5 | 56.9 | **80.6** | **79.3** |

| Reporting area | W-B gap | % residents in state are black | Facilities Grouped by % Black Residents in the Homes | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0% Blacks (L1) | 0.1%–4.9% Blacks (L2) | | 5.0%–19.9% Blacks (L3) | | 20.0%–49.9% Blacks (L4) | | ≥50% Blacks (L5) | |
| | | | Vaccinated | Vaccinated | | Vaccinated | | Vaccinated | | Vaccinated | |
| | | | White | White | Black | White | Black | White | Black | White | Black |
| Nebraska | 6.3 | 3.0 | **80.1** | 76.3 | 70.1 | 80.0 | 74.5 | 81.0 | 75.8 | n/a | n/a |
| New Mexico | 6.3 | 2.0 | **77.8** | 69.0 | 67.9 | 59.2 | 57.0 | n/a | n/a | n/a | n/a |
| South Carolina | 6.0 | 26.6 | **81.7** | 85.8 | 83.7 | 82.2 | 79.0 | 77.1 | 74.1 | **77.4** | **74.7** |
| California | 5.5 | 9.2 | **79.0** | 68.6 | 67.3 | 67.8 | 66.2 | 62.7 | 61.6 | **55.1** | **53.8** |
| Virginia | 5.4 | 21.8 | **81.0** | 76.9 | 75.8 | 73.3 | 72.0 | 70.0 | 68.1 | **69.0** | **68.2** |
| Texas | 5.4 | 12.2 | **83.9** | 81.0 | 79.4 | 78.6 | 77.1 | 76.5 | 75.0 | **75.0** | **73.8** |
| Minnesota | 5.1 | 2.1 | **81.4** | 79.3 | 78.8 | 75.3 | 75.4 | 79.8 | 79.3 | n/a | n/a |
| **Median** | | 9.1 | **80.1** | 77.6 | 74.9 | 75.4 | 72.8 | 70.4 | 68.1 | **70.5** | **68.2** |
| States with 0.1%–4.9% white-black difference in vaccination | | | | | | | | | | | |
| Oklahoma | 4.9 | 6.4 | **84.2** | 84.1 | 83.7 | 80.3 | 79.8 | 79.5 | 79.0 | **81.0** | **80.5** |
| Massachusetts | 4.3 | 3.9 | **77.9** | 74.2 | 75.6 | 75.2 | 75.4 | 64.9 | 65.4 | **73.0** | **73.5** |
| Florida | 4.0 | 12.4 | **76.2** | 60.1 | 59.1 | 58.9 | 58.0 | 58.2 | 57.4 | **58.6** | **57.7** |
| District of Columbia | 3.9 | 74.5 | **n/a** | n/a | n/a | 77.7 | 67.4 | 60.9 | 51.3 | **76.6** | **68.1** |
| Washington | 3.9 | 2.9 | **75.9** | 68.0 | 68.3 | 65.6 | 66.3 | 59.1 | 60.6 | n/a | n/a |
| Mississippi | 3.8 | 32.4 | **87.1** | 80.7 | 75.9 | 83.3 | 79.5 | 81.4 | 76.8 | **80.2** | **76.0** |
| Wisconsin | 3.8 | 3.0 | **78.3** | 77.3 | 74.7 | 77.0 | 74.5 | 77.7 | 75.2 | **77.6** | **75.1** |
| Nevada | 3.4 | 6.6 | **73.5** | 65.1 | 61.2 | 50.1 | 46.1 | 47.4 | 43.3 | n/a | n/a |
| New York | 3.4 | 15.8 | **82.6** | 80.8 | 80.6 | 79.2 | 79.0 | 76.8 | 76.7 | **78.9** | **78.6** |
| Delaware | 3.1 | 17.8 | **89.2** | 80.4 | 78.4 | 74.7 | 72.0 | 81.2 | 79.7 | **71.2** | **67.8** |
| Rhode Island | 2.2 | 2.9 | **78.1** | 73.9 | 74.8 | 68.7 | 70.8 | 65.1 | 67.4 | n/a | n/a |
| New Jersey | 1.8 | 13.3 | **87.5** | 75.0 | 74.6 | 72.6 | 72.2 | 73.4 | 73.1 | **70.1** | **69.5** |
| Arkansas | 1.2 | 12.7 | **76.6** | 81.6 | 79.1 | 80.4 | 78.6 | 81.1 | 76.9 | **81.1** | **79.9** |
| **Median** | | 12.4 | **78.2** | 76.2 | 75.2 | 75.2 | 72.2 | 73.4 | 73.1 | **77.1** | **74.3** |

Results from multilevel models for each state including sex, age, race, total number of residents in the facility during influenza season, and proportion blacks in the facility.

Bold numbers indicate the highest and lowest levels of vaccination.

n/a, not available.

Table includes anyone who ever lived in a nursing facility and had an assessment between October 1, 2008, and March 31, 2009.